CARNIVOROUS PLANT NEWSLETTER

Journal of the International Carnivorous Plant Society

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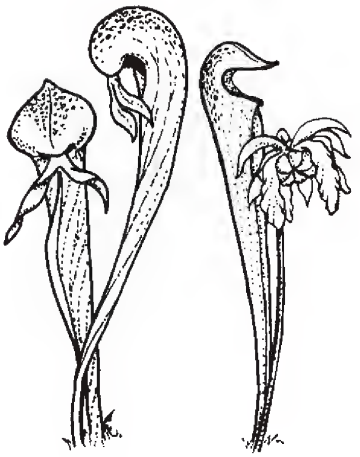

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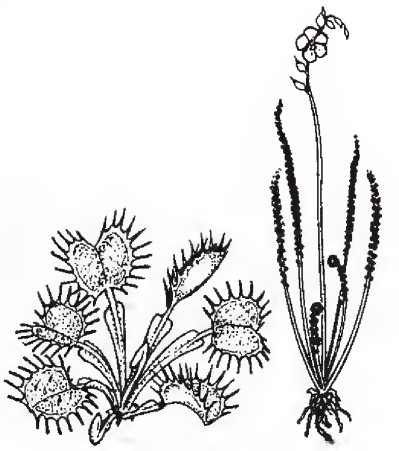

Front Cover: The cultivar *Sarracenia* 'Godzuki'. Photo by Damon Collingsworth. Article on page 96.

Back Cover: *Sarracenia leucophylla*, Tate's Hell Swamp, north Florida. Photo by Brian Barnes. Article on page 92.

Carnivorous Plant Newsletter is dedicated to spreading knowledge and news related to carnivorous plants. Reader contributions are essential for this mission to be successful. Do not hesitate to contact the editors with information about your plants, conservation projects, field trips, or noteworthy events. Advertisers should contact the editors. Views expressed in this publication are those of the authors, not the editorial staff.

All correspondence regarding dues, address changes and missing issues should be sent to the Membership Coordinator at the ICPS. Do not send such correspondence to the editors. Checks for subscriptions should be made to the ICPS in US funds. Dues for 2011 are $35 for the first year of membership; renewals are $30 per year.

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ICPS Conference 2012

The New England Carnivorous Plant Society (NECPS) is honored to have been selected to host the 2012 ICPS Conference. Plans are already underway for the event, which will be held August 11–13, 2012, in Seekonk, Massachusetts, USA (see poster on page 106).

Without a doubt, carnivorous plants are among the most fascinating organisms on Earth. Too often, hobbyists and enthusiasts forget the absolute wonder we felt when we first witnessed a Venus flytrap shutting around its prey or the awe when we first saw carnivorous plants growing in the wild.

Members of the NECPS are reminded of this wonder on an annual basis. Every autumn since our society's inception, we have held a public carnivorous plant show. What began as a small event and an opportunity to simply show off our best plants has grown to include hundreds of display plants, classes, and informational displays. In recent years, the show has attracted over 600 visitors, many of whom had never seen a carnivorous plant before.

In hosting the 2012 ICPS Conference, the NECPS will broaden the message. Wild carnivorous plants around the world are in very real danger of extinction in the wild, whether through habitat loss, mismanagement, or poaching. We have witnessed how people instantly fall in love with these plants and how, when they learn of their plight, they are inspired to help protect them. The first step towards protecting carnivorous plants for future generations is through educating the public. Thus, for the ICPS Conference, we have chosen the theme of Conservation through Education.

In keeping with this theme, we will be holding a large public show in tandem with the conference. Just as the NECPS does for its annual show, we will be holding public classes, have seasoned growers on hand to answer questions, and, of course, have hundreds of beautiful carnivorous plants on display. ICPS members are welcome and encouraged to enjoy the show during the conference and to bring their own plants to display and educate.

The conference will be held at the Johnson and Wales Inn, a hotel and conference center that is owned and operated by a renowned hospitality and culinary school. Located a few minutes from Providence, Rhode Island, the Inn is a perfect combination of easy accessibility (just a few hours from Boston and New York) and quality accommodations. Standard rooms are available for $99 US per night through our group rate; mention New England Carnivorous Plant Society when making your reservation.

Being located on the east coast of the United States, the NECPS is also near some of the most unique and famous carnivorous plant habitat in the world. For several days following the conference, we plan to hold field trips to places such as the Jersey Pine Barrens and the Green Swamp in North Carolina.

For more information on the conference, please visit www.necps.org/icps2012. To receive conference updates by email, please send a request to Emily Troiano, NECPS Vice President, at emily.troiano@gmail.com. We are looking forward to seeing you in New England next summer!

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Erratum: In the June issue of CPN, the names for Joe Mazrimas and Don Schell were reversed in the photo caption in page 56. The photographer's name—Larry Logoteta—was incorrectly spelled in the body of the article.

Utricularia humboldtii seed longevity

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Keywords: cultivation: seed treatment, *Utricularia humboldtii*.

The bladderwort *Utricularia humboldtii* Schomb. is an extraordinary plant in an extraordinary genus. It is a plant both well known and greatly desired by carnivorous plant horticulturists because of its enormous leaves and spectacular flowers; some growers even value it for its especially large bladders. Those interested in the natural history of carnivorous plants delight in its frequent occurrence within the water-filled urns of large bromeliads, including *Brocchinia reducta*, which may itself be carnivorous (Rice 2006).

As if ensuring that no aspect of it bores, *Utricularia humboldtii* even has amazing seeds! They are large in outline (approximately 2-5 mm long and 1.5-2 mm wide) yet membranously thin and transparent. The middle portion of each seed bulges outwards, evoking the shape of a stuffed ravioli. In this case, the stuffing is a tiny, octopoid plantlet, already bright green and visible through the transparent seed walls. These seeds germinate immediately upon being moistened, like toy store compressed sponges that expand into brightly colored dinosaur and barnyard animals.

We were overjoyed when the *Utricularia humboldtii* we grow at the University of California (Davis) Botanical Conservatory flowered. Its flowers were enormous and flamboyant beyond expectations. And when selfed flowers produced seed, we enjoyed the spectacle of their rapid germination.

We took advantage of this event to investigate seed longevity, and the best way to prolong their viability. As far as we knew, this avenue of study had not been explored. We also made a few observations on the very early development of the seedlings. Finally, not wanting to be alone in our pleasure, we sent the bulk of our seeds to Travis Wyman, who selflessly distributed seeds to all who contacted him.

Methods

At maturity, the seed capsules of *Utricularia humboldtii* are approximately 1.5 cm long and resemble small pale green olives in both shape and color. The membranous seed escape from the capsules by a ventral slit, presumably to be dispersed by wind. Our first fruit, from which we harvested approximately 500 seed for this experiment, matured on 28 March 2008.

We first tested the viability of twenty seeds by dropping them onto the surface of purified water in a Petri dish. The dish was placed 5 cm underneath six cool white fluorescent bulbs with a 16 h:8 h light:dark photoperiod. Daytime temperatures peaked at 31°C, nighttime temperatures dropped to 24°C. Within 24 hours, 18 of the seed had germinated. Reexamined after three and six days, no further seeds germinated.

We divided our ungerminated seed into three subsamples, stored in dry, loosely sealed Petri dishes (see Table 1). One subsample ("Room conditions") was stored in the dark at room temperatures. A second subsample ("Terrarium conditions") was placed in a 240-liter carnivorous plant

Table 1. Storage conditions for the three subsamples of *U. humboldtii* seed.			
Subsample	Illumination	Temperature	RH
Room conditions	0:24h Light:Dark	22±1°C	47%
Terrarium conditions	17:7h Light:Dark	23±1°C	73%
Refrigerated	0:24h Light:Dark	4±1°C	25%

terrarium, approximately 40 cm beneath four fluorescent bulbs. This terrarium housed a collection of *Pinguicula*, *Utricularia*, young *Nepenthes* and seedling *Sarracenia*, and so was demonstrably an environment suitable for growing carnivorous plants. A third subsample ("Refrigerated") was placed in a refrigerator. The temperature and humidity in these three storage areas were measured using a digital infrared temperature scanner (Omega Engineering, OS90 series) and a digital sling psychrometer (Mannix, SAM 990DW).

Every three days, fifteen seeds from each subsample were dropped into Petri dishes filled with purified water. The dishes were placed 5 cm beneath a set of fluorescent bulbs. The dishes were inspected after one, three, and six days, and the numbers of seeds germinated were counted. We defined germination to have occurred if at least one of the arms of the seedling had emerged from the confines of the seed walls.

Results and discussion

Figure 1 shows the results for the seeds stored in the dark, at room temperature. The three solid lines trace the germination rates measured 1 day, 3 days, and 6 days after being placed in water. Final germination rates are high, 80-100%, for the first 12 days of storage. After that, seed viability drops steadily, reaching 0% viability at an age of approximately 27 days.

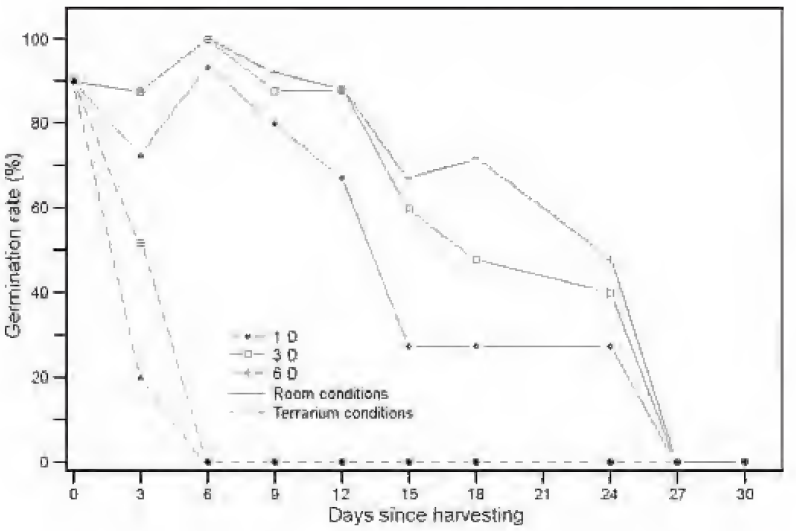

Figure 1: Germination rates for seeds, as measured 1 day, 3 days, and 6 days after being put in water. The x-axis indicates the seed age (number of days after capsule dehiscence) at which point the seeds were first moistened. The solid lines indicate results for seeds stored in the dark, at room conditions. Note the viability drops significantly after approximately 12 days. The dashed lines indicates results for seeds stored in an illuminated, humid terrarium; the viability plummets and the seeds are dead within just a few days.

The data for the seeds stored inside a humid carnivorous plant terrarium are also plotted on Figure 1, but with dashed lines. Although this sample was stored in what might seem to be hospitable conditions, the setting was deadly for the seeds. After only 3 days the seed viability dropped to approximately 50%, and after 6 days the seeds were

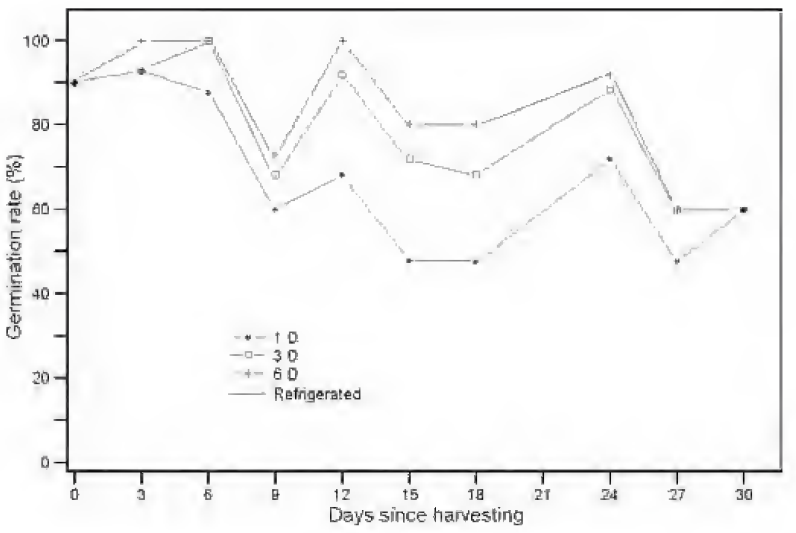

Figure 2: Germination rates for seeds stored in a refrigerator. The data presentation is as in Figure 1. Notice the seeds stay highly viable for at least a month.

entirely nonviable. Although the conditions were humid, it is likely that the high light levels forced the seedlings in the transparent seeds to photosynthesize, and in the process the seeds dehydrated.

Interestingly, the seeds in cold storage survived the longest (see Figure 2). Germination rates exceeded 80% after 24 days. Even at 30 days—when the supply of seeds ran out for this experiment—germination rates were still at 60%. While this result may not surprise managers of seed banks, it is still interesting that cold storage was the best environment for these extremely delicate seeds of tropical species.

One would expect that in the wild, seeds are likely to be exposed to high light levels, and Figure 1 indicates that such seeds will have a very short lifespan. Finding a suitable environment to encourage germination must happen very quickly if the seeds are to survive.

Meanwhile, horticulturists would do best to harvest seeds of these plants immediately upon their release from the capsules. Even a few days of desiccation in normal growing conditions will decrease seed viability. The best way to store seeds is in the refrigerator or, barring that option, in the dark.

Seedling observations

Watching the seeds germinate over a matter of hours was fascinating. Seeing the seedlings almost crawl out of the seed coats, it was easy to forget they were not animals!

First, it became clear that the rapid germination is not due to a simple matter of the seed coat dissolving, either entirely or along fission lines. If such were the case, we would have seen the emergence of seedlings even from dead seeds. Instead, germination appears to be a growth process caused by the extension of the curved, tentacular seedling arms. This process forces the seed coat to rupture (see Figure 3).

Upon emergence, the seedling consists of 6-8 filamentary, radially arranged leaves. Each leaf is ternately divided into three uniformly diverging arms. The leaves and its segments are strongly diverging, effectively filling a spherical volume (see Figure 4).

A few days later, the seedling produces a new filamentary shoot from the center of the plantlet. This shoot elongates, and develops bladders and leaves. These early leaves are highly flattened. As the plant continues to grow, it develops into the familiar juvenile form consisting of many filmy, aquatic, divided leaves. After several months of good conditions, when the plant has gained sufficient biomass, it will produce the familiar paddle-shaped, aerial leaves.

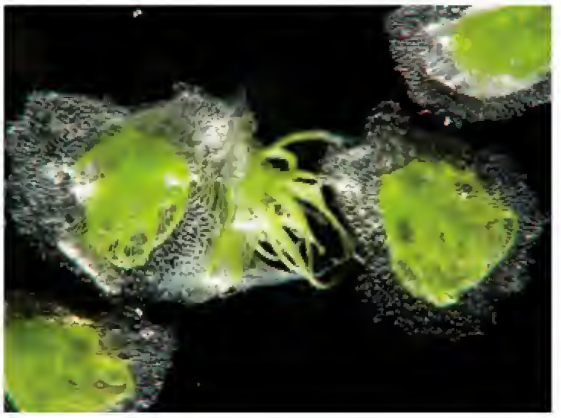

Figure 3: *Utricularia humboldtii* embryos can be observed while still within the seeds. The middle seed has just burst from its seed coat, and the seedling arms are still mostly recurved.

Figure 4: A slightly more advanced *Utricularia humboldtii* seedling, with its filamentary arms fully extended. Another seed is germinating at lower left.

Acknowledgements: We thank Tim Metcalf and Ernesto Sandoval at the University of California Davis Botanical Conservatory for their tireless efforts at growing fine plants such as *Utricularia humboldtii*.

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THE

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Natural abundance of stable isotopes reveals the diversity of carnivorous plant diets

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Keywords: carbon, *Cephalotus*, *Dionaea*, *Drosera*, *Nepenthes*, nitrogen, nutrients, *Roridula*, stable isotopes.

Ever since carnivorous plants were first described and studied by early naturalists (*e.g.*, Darwin 1875), there has been continued interest in the relationship between the uptake of nutrients from invertebrate prey and the growth and performance of these plants. Although it is now thought that multiple nutrients appear to limit the growth of most carnivorous plants (Ellison 2006), of particular interest has been nitrogen (N), as many studies have shown that carnivorous plants can obtain extra N from the digestion of their prey.

In recent years, the use of stable isotopes has increased in ecological research, especially to shed further light on carbon (C) and N cycling in ecosystems. Stable isotopes are elements which have an extra neutron *e.g.*, ^{15}N *versus* the more common ^{14}N. They are relatively uncommon in the environment where typically less than ½% of N atoms are the heavier ^{15}N isotope, but they are often sufficiently abundant to use as non-radioactive tracers of elemental movement through ecosystems. Stable isotopes are measured using an isotope ratio mass spectrometer and recorded using delta (δ) notation. In the case of N, this is the ratio of ^{15}N:^{14}N relative to that of atmospheric N (which has 0.36765% ^{15}N): positive δ values (measured on a ‰ scale) mean more ^{15}N than the atmospheric standard, whereas negative values mean less ^{15}N than this reference value. Given the importance of N in the growth of many plants, and especially carnivorous plants, the use of N isotopes has proved very useful in shedding further light on N nutrition in these organisms. They are particularly useful when the question of interest is not necessarily "how much?" but "where from?"

As trophic levels are ascended, there is an increase in the $\delta^{15}N$ values of the organisms by about 3.4‰ relative to their food substrate (Post 2002) and, therefore, insects generally have a more enriched $\delta^{15}N$ signature than the majority of plant foliage upon which they feed. By using simple mathematical mixing models (*e.g.*, Moran *et al.* 2001, 2003; Brearley *et al.* 2003) which compare the $\delta^{15}N$ values of reference plants which are not capturing insects with those which have consumed and digested insects, it is possible to calculate the uptake of N from insects, provided the $\delta^{15}N$ values of the insect prey are known.

The first study to use stable isotope methodology to examine N uptake from insects was that of Schulze *et al.* (1991), who looked at various Australian *Drosera* species. They found that N derived from insect prey was much greater in larger shrub-like or vine-forming individuals than in smaller rosette-forming plants. Follow-on work assessing the proportion of N obtained from insect prey in a wider range of species (Schulze *et al.* 1997) suggested that all of the N in young leaves of *Nepenthes mirabilis* was obtained from insects but this value declined as pitchers aged and N was re-allocated. In *Cephalotus follicularis*, it was suggested that only plants with more than four open, and presumably functional, pitchers obtained a measurable amount of N from insect capture (Schulze *et al.* 1997). More recent work by Millett *et al.* (2003), using a similar methodology, suggested that the mean proportion of N derived from insects was 50% in three British populations of *Drosera rotundifolia*.

In these initial studies there were a number of caveats: researchers often used non-carnivorous plants as reference plants to compare with the carnivorous plants but other factors may affect the

reference plants' $\delta^{15}N$ signature such as symbiotic root-inhabiting mycorrhizal fungal associations, rooting depth and the dominant form of N (*i.e.*, ammonium, nitrate, or even organic N) taken up by the plants (Högberg 1997; Robinson 2001). In addition, there may be internal physiological processes at work which will affect plant $\delta^{15}N$ such as re-absorption of nutrients. Therefore it is more appropriate for researchers to use reference plants as closely related as possible to the carnivorous plants under study.

To determine N uptake in *Dionaea muscipula*, Schulze *et al.* (2001) employed a more complex strategy due to the wide range in $\delta^{15}N$ values of different insect prey species. Total N derived from insects was determined as a function of the dependence of each plant part (*e.g.*, roots, leaves, flowers) on N obtained from the traps of each plant and the proportional weight of each plant part to the plant's total weight. Schulze *et al.* (2001) showed that the proportion of insect derived N decreased from an early successional state after fire (*c.* 75%) to lower values (*c.* 45%) as other grasses and shrubs overtopped the fly traps.

Many *Nepenthes* species catch a high diversity of prey, with ants being their most common prey item (Moran 1996; Di Giusto *et al.* 2008). However, *N. albomarginata* has a strong preference for catching termites (Merbach *et al.* 2002). Moran *et al.* (2001) compared the N isotope ratios of the termite-catching *N. albomarginata* with that of *N. rafflesiana* which prefers ants. There were considerable differences in the two species' N isotope ratios (*N. albomarginata*: ∴2.1‰; *N. rafflesiana*: 1.9‰) which could be related to the clear differences in $\delta^{15}N$ of the two prey insect groups (termites: ∴4.0‰; ants: 2.0‰). In a more interesting twist on carnivorous diets, we often think that carnivorous plants obtain their nutrients from insect prey (and occasionally other fauna) but there is actually little stopping them obtaining nutrients from leaves if they happen to fall into the pitchers, although many species have a lid which may prevent this from happening. *N. ampullaria* has an unusual habit and morphology as it forms clusters of pitchers on the closed canopy forest floor and the pitcher mouth is not covered by the lid as in most *Nepenthes* species. These observations led Moran *et al.* (2003) to suggest that that it may be more involved in obtaining nutrients from leaf litter than other species. This was tested by examining the stable isotope ratios of plants growing in the open (∴0.20‰) compared with those under a forest canopy (∴2.22‰). As the $\delta^{15}N$ of leaf litter was much more negative than that of the insect prey, they concluded that plants under the canopy were obtaining a sizable proportion of their N from leaf litter. The most recent addition to the diversity of food items trapped by pitcher plants is that of animal faeces which are used by *N. lowii* in tropical montane forests where ant numbers are much lower. Clarke *et al.* (2009) showed that faeces of tree shrews, which feed on exudates from the pitcher lid whilst squatting over the pitcher opening, accounted for almost the entire N utilised by this species in some cases.

Another species in which N uptake has been studied using stable isotopes is the sticky-leaved *Roridula gorgonias* over which inclusion into the carnivorous plant pantheon has been questioned as the plants do not produce any digestive enzymes. However, they do have notably elevated $\delta^{15}N$ values (Midgley & Stock 1998) indicating that a considerable proportion of plant N is derived from an insect source. When insects become trapped on the hairs of *Roridula* they are rapidly consumed by hemipterans resident on the plant which excrete the undigested insect remains; the N within which appears to be absorbed by the leaf surfaces of *Roridula* (Ellis & Midgley 1996). Furthermore, another species of *Roridula* hosts spiders which prey on the hemipterans and it was shown that plants with a higher density of spiders had a lower hemipteran density resulting in less N obtained from insect excretions (Anderson & Midgley 2002). It would be interesting to determine the relative importance of hemipteran *versus* spider excretions in the N nutrition of the two *Roridula* species although this would probably require an isotopic labeling study. Overall, *Roridula* receives up to 70% of its N from insects

although only when the hemipterans are present at a high density (Anderson & Midgley 2002) showing a fascinating three-way mutualistic interaction in the feeding strategy of this carnivorous plant.

Finally, stable isotopes have also been used in studies of pollution ecology (*e.g.*, Van Dover *et al.* 1992), specifically to trace their sources. A potentially useful example, where the source of N for *Drosera* species has been examined in relation to changing N inputs, is that of Akagi and Osawa (2005), who showed that $\delta^{15}N$ of *D. rotundifolia* in a Japanese bog was increased where there were more recreational benches; they suggested that this was due to increased human "pollution". However, there is an alternative explanation for this relationship as plants with higher $\delta^{15}N$ values had a larger number of trapped insects. This relationship was weak but is a confounding factor in the results which indicates that this method may have potential if utilised appropriately.

In conclusion, N isotopes have been shown to be a powerful tool to examine N uptake in carnivorous plants as insect $\delta^{15}N$ values are generally enriched in relation to plant $\delta^{15}N$ values thus allowing us to trace movement of N in the ecosystem. When the question of interest is "how much?", it has been shown that most carnivorous plants obtain up to 75% of their N from insect prey. When the question of interest is "where from?" using *Nepenthes* as a specific example, recent use of stable isotopes has revealed that certain species have a much more specialised diet than originally envisaged.

Acknowledgements: I thank Jonathan Moran and Gemma Muckle for helpful comments on the manuscript.

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Tuberous organs in *Utricularia*, and new observations of sub-tuberous stolons on *Utricularia radiata* Small

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Keywords: observations: Texas, *Utricularia radiata*, *Utricularia inflata*—physiology: *Utricularia radiata*.

The genus *Utricularia* is confounding and bizarre. You are simply wrong if you think that the genus can be dismissed as a set of free-floating lake weeds, or stringy terrestrial species with tiny leaves. Many of its species produce mysterious, strange structures; the diversity of peculiar things exhibited by *Utricularia* species astonishes.

The production of tubers is such an example—nearly twenty species of *Utricularia* are known to generate them. (Plant physiologists might argue whether all these structures are truly tubers in the technical sense.) The species that produce tubers are not particularly closely related to each other; Taylor (1989) notes that they occur in six separate sections (*Aranella*, *Chelidon*, *Orchidioides*, *Phyllaria*, *Pleiochasia*, *Utricularia*).

Despite this diversity, *Utricularia* tubers can probably be divided into two main types. Tubers of the first type function as water storage reservoirs. Consider species in the section *Orchidioides*—many of these plants are epiphytes that live on trees, and rely upon the small amount of moisture that unreliably trickles down the branches. Dehydration is a significant risk, so water-storing tubers are a good insurance policy for survival. Storing carbohydrates (*i.e.*, food) is probably only a secondary function for these tubers.

Section *Orchidioides* is known for its horticulturally finicky members. But it is equally well known that, if cajoled into survival, these plants reward the grower with spectacular flowers. *Utricularia alpina* is the species most likely to be cultivated (Wyman 2008), but other species such as *U. jamesoniana* are fairly easy to grow. In horticulture, *Orchidioides* tubers are not useful in propagation, although exploring this further might be an enlightening and productive field of research.

The second type of *Utricularia* tuber consists of those that function as a carbohydrate reserve. The best-known example of this is *Utricularia menziesii*, which is dormant during the long, hot, dry summers of its native southwestern Australia. Each fall it emerges from dormancy, powered by the energy resources stored in its cluster of carbohydrate-rich tubers at the inflorescence base. For the horticulturist, these tubers provide a convenient way to ship plants during dormancy. Furthermore, by judiciously separating the tubers, plants can readily be propagated.

These two types of *Utricularia* tubers occur in many forms. Frequently, as in the epiphytic *Utricularia*, they are loosely clustered near the bases of inflorescences. But this is certainly not the only model for tubers in the genus! In *U. brachiata*, only a single tuber is produced by the plant, and it is located directly under the flower stalk. *Utricularia christopheri* also produces a single tuber, but it is located a little deeper in the soil—it is attached to the rosette by a little shoot. This is similar to the *Genlisea pygmaea* tubers observed by Rivadavia (2007). *Utricularia mannii* has a single basal tuber, but it also produces smaller ones on its stolons. Probably my favorite of the group, the peculiar *U. moniliformis*, has multiple tubers strung together on the stolons like sausages on a string!

Figure 1: *Utricularia inflata* tubers on long, strand-like shoots. The tuber at far left has extruded a new growth.

The familiar *Utricularia inflata* also produces carbohydrate-rich tubers, although they are only a few mm in diameter (see Figure 1). *Utricularia inflata* is in the genus section *Utricularia*, which includes the most common aquatic or semi-aquatic species such as *U. australis*, *U. gibba*, *U. macrorhiza*, and *U. vulgaris*. (The related *U. platensis* also generates tubers.) Tubers can usually be found on large *U. inflata* plants, and their presence is a useful way to distinguish it from similar species (such as *U. macrorhiza*). Supposedly, being stranded on mud is particularly conducive to encouraging *U. inflata* plants to produce tubers (Taylor 1989). But why the plant produces its tubers on whip-like shoots, several cm long, defies easy explanation!

In April 2006, I visited eastern Texas and was led on fascinating trips to several carnivorous plant sites by Mike Howlett and Michael Pagoulatos (Rice 2006). Our trips were focusing on *Sarracenia alata*, *Pinguicula pumila*, and *Utricularia purpurea*, but there were many other things of interest to see. One Harris County site that Mike promised to show me boasted a plant that he claimed was *Utricularia radiata*. This was surprising to me, since Taylor (1989) did not record the species in Texas.

Unfortunately, it had been a dry year and upon our arrival we saw that the water levels at the *Utricularia radiata* site were lower than optimal. Standing on the edge of the muddy wetland we could not see any carnivorous plants at all—it certainly was not choked with *Utricularia*. Still, we were there, so we carefully explored the muck and after much poking around, we found a few shoots embedded in the mud. The specimens were pathetic—short stolon fragments a decimeter or so long. Most did not even have leaves, but the few leaves that were present showed the very regular dichotomous branching that is characteristic of *U. radiata*. Clearly, Mike's dubious claims were vindicated. (I have since seen herbarium specimens of *U. radiata* from other Texan sites.)

In my experience, *U. radiata* usually grows as an annual, so I surmised that the plants we were seeing were in their death throes. However, as I extricated lengths of stolon from the mud, I was

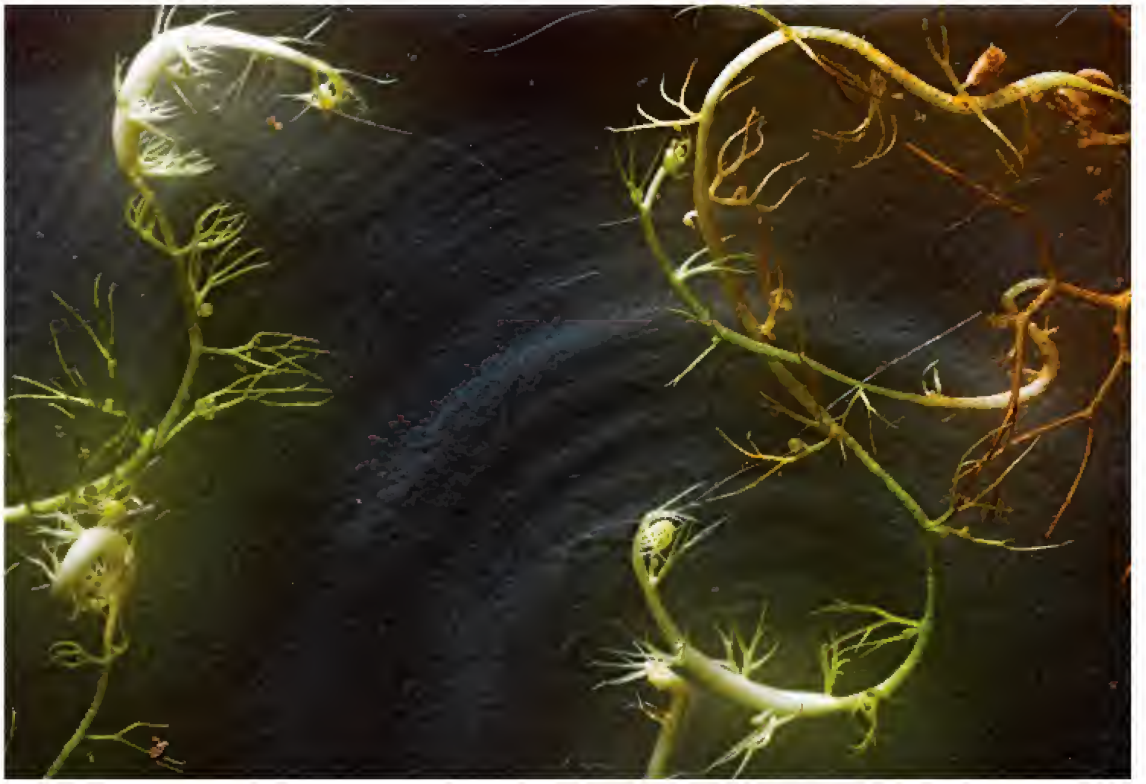

Figure 2: *Utricularia radiata* shoots with swollen, sub-tuberous, chlorophyll-free segments.

surprised to see that intermittent lengths of the shoot were swollen, and lacking in chlorophyll (see Figure 2). Unlike the flexible, green parts of the shoots, these swollen lengths were stiff and, when broken, were clearly supplemented by starchy tissues. Quite frequently, the swollen stolons were twisted around in small loops, almost knot-like in character (see Figure 3).

I do not know of these structures having been observed before. I can only surmise that they were produced by the *Utricularia radiata* plants in response to the temporarily inhospitable conditions of the season. So not only was I surprised to learn that *U. radiata* occurred in Texas, we were both surprised to discover that it probably grows as a perennial, and a sub-tuberous one at that!

As there were not many plants at the site, I took only a few small fragments with me to photograph. Remarkably, after only 48 hours at room conditions, the knot-like loops straightened, the tuberous shoots lengthened and developed chlorophyll, and leaves started to form. Truly, these sub-tuberous shoots were powerful energy sources! Unfortunately, I was unable to provide suitable growing conditions rapidly enough and the plants perished. However, strains of *U. radiata* such as at these Texas sites have potential for the specialist horticulturists who might find the usual, annual nature of the species to be frustrating.

Acknowledgements and notes: I would like to thank Mike Howlett in particular for his kindly provided guidance as we traveled through Texas together. No permits were required to visit or collect material from the site described in this paper.

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Figure 3: *Utricularia radiata* shoots with swollen sub-tuberous organs, twisted into short loops. The loops at top right and middle-left are starting to uncurl.

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ICPS 2011 CONSERVATION REPORT

BRIAN BARNES • Conservation Director • brian@carnivorousplants.org

As we rapidly are coming to the end of another great growing season, I wish to let our members know about some of the fantastic efforts and accomplishments supported by the ICPS. In May 2011, I had the great pleasure of touring and filming parts of the southeastern U.S. with renowned CP film makers Siggi and Irmgard Hartmeyer as part of a collaborative effort with the ICPS to raise awareness of conservation on more of a global scale (see Fig. 1). Our mission was a success! We also filmed a good friend's local tissue culture lab which also specializes in carnivorous plants that are offered for sale to the public (see Fig. 2). We believe that this effort discourages poaching by making plants available cheaply and in mass quantity.

I am also pleased to report a successful burn year at the Splinter Hill Bog and the Roberta Case Preserve, which is home to the rare *Sarracenia alabamensis* (see Fig. 3). These efforts were made possible by the generous donations of our ICPS membership, for which we are very grateful. There were even enough funds remaining for a new Splinter Hill Bog sign, which now adorns the main public entrance to the bog (see Fig. 4). The plants are responding nicely to the prescribed fire, although the extreme drought in the southeastern U.S. has hampered flowering. I counted fewer flower spikes this year compared to last year and we can only hope that summertime showers will improve conditions. Many of our CP friends worldwide have also reported unusually dry conditions elsewhere this year and this definitely has an effect on *in situ* populations. We observed many dry, parched bogs that should have been quite wet at the time we were there.

Figure 1: Siggi Hartmeyer filming a rare *Sarracenia* hybrid in Alabama, with Irmgard supervising.

Figure 2: From left, Irmgard, Siggi, and Mike Rinck of AG 3 tissue culture lab.

Figure 4: A new Splinter Hill Bog sign made possible by our wonderful ICPS members!

Siggi, Irmgard, and I were quite alarmed at the rate that *S. leucophylla* continues to be poached in Tate's Hell Swamp in the Florida panhandle. I have interviewed a few locals that told me that the floral shops in northern Florida pay the poachers 25 cents for each cut pitcher, which are then used in flower arrangements. However, plants are now being dug and sold in local flea markets from $5 to $10 each. Poaching seems to be escalating due to the poor economy and lack of jobs. The swamp itself is surrounded by tall dense growth which provides perfect cover to hide the poacher's presence from the main roads. We saw many signs of vehicles having been driven throughout the area; along with numerous holes which once contained plants (see Fig. 5). Some of these now missing plant clumps were easily two to three feet in diameter. I am now preparing a letter of concern which will

Figure 3: A recently burned CP site in Alabama.

be sent to the State of Florida Park Services regarding this issue. If we could get the high roadside overgrowth cleared and increase ranger patrolling, I'm sure this would serve as a poaching deterrent.

On a more positive note, the ICPS will be working to reintroduce *Sarracenia alabamensis* genetic material to the Roberta Case Preserve, to insure that the native populations remain strong. Atlanta Botanical Gardens has been maintaining and propagating site material. I will be meeting with Ron Determann and arranging some volunteers to make this happen and will keep the membership updated on our endeavors. Until then, we wish you all "Happy Growing" and thank you all for your wonderful donations. If you wish to donate to an ICPS Project, please visit the ICPS webpage (http://icps.clubexpress.com) and click on the Donate Now button. Thank you!

Figure 5: A site of *Sarracenia leucophylla* ravaged by poachers in Tate's Hell Swamp, Florida panhandle.

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New cultivars

Keywords: cultivar: *Dionaea muscipula* 'Fondue', *Sarracenia* 'Godzuki', *Utricularia* 'Merrie Heart'.

Dionaea muscipula 'Fondue'

Submitted: 22 March 2011

Dionaea muscipula 'Fondue' was found at the Carniflora open day on May 17, 2008. The most spectacular feature of this new cultivar is the strange shape of the traps — they look like molten or melted plastic (see Fig. 1). During spring, the traps can look like the typical Venus flytrap, but during summer and autumn most of the later traps look molten (see Fig. 2), even petioles can appear molten (see Fig. 3). Sometimes plants do not produce typical traps in the spring, but directly produce molten traps. Because of the shape of the traps, this Venus flytrap does not catch much prey so the inside of the traps are a deep red color during most of the year. Fondue means molten in French. Vegetative propagation is necessary to maintain the unique features of this plant.

—Guillaume Bily • 10 allée des pétrels • 56520 Guidel • France • gbily2003@yahoo.fr

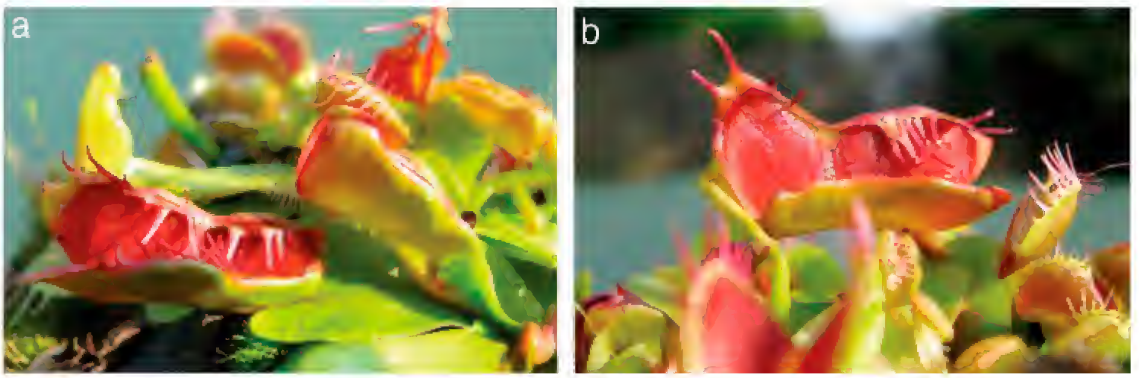

Figure 1: Molten traps of *Dionaea muscipula* 'Fondue'.

Figure 2: Normal and molten traps of *Dionaea muscipula* 'Fondue'.

Figure 3: Molten petioles of *Dionaea muscipula* 'Fondue'.

Submitted: 13 June 2011

Many years ago I received this clone from Tom Kahl, who had received it from Leo Song. Leo managed the greenhouses at California State University at Fullerton for many years and was also co-editor of CPN for a long time.

Sarracenia 'Godzuki' is a clonal selection of a cross Leo did between *S. oreophila* and *S. minor* (*S. oreophila* × *minor*). My nursery California Carnivores has sold and distributed many of these plants under the hybrid name *Sarracenia oreophila* × *minor.*

Sarracenia 'Godzuki' is a vigorous, fast-growing plant that readily spreads and clumps in cultivation, producing many pitchers throughout the growing season. The pitchers average about 25 cm in height, but can reach up to 45 cm. The domed, semi-curved lid completely covers the mouth and its exterior is heavily veined and becomes copper red in full sun, while the interior becomes equally flushed with a bronze-red coloration. As it ages, the entire tube of the pitcher can become rather bronzy red against a green to olive background.

Several things are particularly noteworthy in *S.* 'Godzuki'. The medium-sized bright yellow/green flowers open simultaneously with the opening of the first pitchers of the season (see Fig. 4 and Front Cover). The flower petals can last in prime condition for up to three weeks, around three times longer than typical American pitcher plants.

Figure 4: *Sarracenia* 'Godzuki' pitcher and flower. Photo by Damon Collingsworth

It is most unusual, but we have never seen pollen released by the anthers, however the stigmas are receptive to the pollen of other *Sarracenia*.

Clumps of this clone can produce a floriferous display in spring. All of the pitchers face inward, toward the center growth point of the plant. The plant is very cold hardy, since *S. oreophila* is one of its parents.

It is the lizard-like appearance of *S.* 'Godzuki' that inspired us to name this clone after the son of Godzilla, a famous character in many Toho Film Productions.

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Utricularia 'Merrie Heart'

Submitted: 13 June 2011

Utricularia livida is a popular plant in cultivation, however most clones of this species originated from South Africa. Strangely enough, this species is also widespread throughout Mexico.

The Mexican variety is even more attractive in flower than the African variety and is equally easy to grow. It flowers prolifically, most often from spring through autumn, but it can bloom in winter as well if kept warm and in high light levels. It is tolerant of light frost and brief freezes.

The flower stalks average 7.5 to 15 cm in height but can be taller, with upper portions of the stalk each lasting several weeks in bloom. The flower's apron-like lower lip is slightly irregular along its edge, suffused with purple-violet coloration, and measures nearly 1 cm across (see Fig. 5). The tiny upper lip is two–pronged. The forward facing curved spur is hidden below the larger lower lip and is also violet in color.

Figure 5: *Utricularia* 'Merrie Heart' flowers.

There is no yellow throat in the spur, as in its African sibling. It has never produced seed to my knowledge, but is easily propagated through divisions. The sizeable surface stolon are irregularly tear-drop shaped and measure roughly 1 cm in length.

We have named this plant *Utricularia* 'Merrie Heart' after the affectionate spelling Francis Ernest Lloyd used for his beloved wife, Mary Hart. Mary was born November 6, 1865 in Boston, Massachusetts and was a graduate of Wellesley College. She was a professor of Biology at the Western College for Women, in Oxford, Ohio until she married Lloyd in 1903. She died in 1948 in Carmel, California.

Lloyd's obsession was *Utricularia*, and *U. lloydii* is named after him. The Lloyds lived in Mexico for some years. See my article "Lloydie" in CPN, Vol. 39, No. 2, June 2010.

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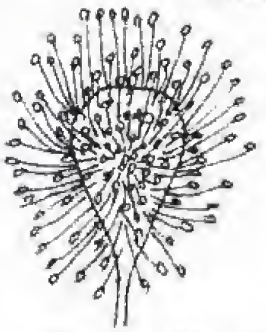

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Unusual aspects of phytocenology of *Drosera rotundifolia* L. (Droseraceae Salisb.) in Central Russia

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Keywords: phytocenology, biology, Central Russia, observations: *Drosera rotundifolia*

Distribution

Common sundew (*Drosera rotundifolia* L.) is an insectivorous plant in the Droseraceae family. *Drosera* is the largest genus of this family, containing more than 90 species. Representatives of this genus are found in almost all climatic belts of both hemispheres. Most species of *Drosera* are located in Australia, New Zealand, and South Africa (Lloyd 1942; Denisova 1981).

Common sundew is a boreal circumpolar species typical of oligotrophic and mesotrophic swamps of the taiga zone. Its range includes forest regions of the European part of the former USSR, the sub polar and polar Urals, middle and southern taiga regions of Siberia; isolated populations of common sundew are present in the Putorana Mountains, Russian Primorye and Priamurye, on Sakhalin, Kuril Islands, and in Kamchatka. It covers almost all of Western Europe (excluding Mediterranean), as well as Japan, Aleutians, Alaska, extreme southern Greenland, and forested areas of North America south to central California and Nevada, along the Atlantic coast from Labrador and Newfoundland south to Pennsylvania and Virginia and isolated areas in the mountains of Alabama and Florida (Arctic flora of the USSR 1984). In central Russia, common sundew is found in all regions, but here it becomes a rare plant and needs protection (Gubanov *et al.* 1976; Gubanov *et al.* 1987).

Ecology

Common sundew grows in many wetland habitats, including oligotrophic and mesotrophic sphagnum swamps, bogs, peat pond surroundings, and more rarely on peat along ditches. It is a typical representative of moss bogs, able to succeed after annually growing moss with the help of growing shoots (Gubanov *et al.* 1987). Common sundew is usually found in the central part of oligotrophic swamps (Yurkovskaya 1980).

Common sundew reaches its highest abundance according to the scale of L.G. Ramenskij *et al.* (1956) at degrees of moistening from 87 to 92 (swamp-meadow moistening). It is an indicator of wet habitats (degree 5 of E. Landolt (1977) scale). Common sundew is an indicator of poor soils (degree 1 of E. Landolt scale); according to L.G. Ramenskij *et al.* (1956), it occupies degree 1-2 of scale of soil fertility (especially poor soils and peat). According to B.A. Bykov (1965), it is a mesohygrophilous plant. E. Landolt treats common sundew as an indicator of raw humus or peat (degree 5 of the scale).

Usage

Common sundew is an ancient medicinal plant. The aboveground part of it is used in the treatment of some diseases of the respiratory system. Plumbagin and droserone, suppressing growth of pathogenic fungi and bacteria, were extracted from this plant. Before the appearance of antibiotics, common sundew drugs were used during treatment of lung tuberculosis and pertussis. Because of

Figure 1: Common sundew on dry sand (Photo by Anna N. Demidova).

Figure 2: Collecting common sundew on dry sand (Photo by Anna N. Demidova).

Figure 3: *Drosera rotundifolia* L. with *Calamagrostis epigeios* (L.) Roth on dry sand (Photo by Anna N. Demidova).

Figure 4: View of club moss – common sundew community on dry sand (Photo by Anna N. Demidova).

spasmolytic and cough-calmative action of common sundew leaves, they are used in antitussive teas. In northern Russia, leaves were used even for steaming of milk jugs, because ferment present in the leaves dissolves proteins even in the porous walls of milk crockery. In Italy, common sundew was used for preparation of liqueurs (Gubanov *et al.* 1976).

Aboveground parts of common sundew contain quinones, plumbagin, and droserone, vitamin C, malic, citric, and benzoic acids, flavonoids, tannins, and other substances. They have an anti-inflammatory, spasmolytic, expectorant, bactericide, sweating action. Infusion of common sundew is used during treatment of catarrhal diseases, bronchitis, and bronchial asthma. Nowadays it is used only in vernacular medicine and homeopathy (Gubanov *et al.* 1987).

Unusual finding

We made an especially interesting finding of common sundew at the end of July 2010, during an expedition devoted to study of flora and vegetation of the Unzha river basin (Kostroma region, central Russia). In the system of botanical-geographical zoning of the European part of the former USSR, the area under study belongs to Valdai-Onega sub-province of north European taiga province of Eurasian taiga (conifer forest) region (Isachenko & Lavrenko 1980).

Sundew was found in non-typical habitat – in dry sand borrow both at concave and prominent relief elements (see Figure 1). The finding was made in Mezhevskoi district of Kostroma region, 5 km south of Gubino settlement (58°40.241'N latitude, 45°02.868'E longitude, 140 m above sea level). Here, in dry sand, after two-month drought, both vegetative and well-developed flowering specimens of common sundew about 20 cm in height were observed in a practically monodominant population (with an insignificant presence of vegetative shoots of *Calamagrostis epigeios* (L.) Roth) in an area of about 150 m^2 (see Figures 2 and 3). It is of interest that we did not find any swamps with common sundew in the neighborhood of this borrow. It is known that common sundew can spread long distances with the help of wind due to the light ventricose seeds having appendices and fuzz (Masing 1955, cited by Balandin & Balandina 1993).

About 100 m from the first point, at abandoned overgrowing elevated sites of the borrow with plain relief, we have found and described another extremely interesting community with a predominance of *Lycopodium clavatum* L. and *Drosera rotundifolia* L. (see Figures 4 and 5). This site was about 400 m^2; *Betula pubescens* Ehrh. (+), *Pinus sylvestris* L. (1), *Alnus incana* (L.) Moench (1), *Populus tremula* L. (+) about 1.5 m in height were present in the undergrowth (estimation of abundance/coverage of undergrowth and herbs is used according to Braun-Blanquet (1921) scale: + – the species is present scantly (projective coverage up to 1% of the description square), 1 – significant amount (projective coverage equaling 1-5% of the square), 2 – the species is abundant, but projective coverage is lesser than 25%, 3 – the species is well developed (projective coverage equaling 25-50%), 4 – projective coverage 50-75%, 5 – continuous closed cover (projective coverage 75-100%)). Species names of vascular plants in our geobotanical description are given according to S.K. Czerepanov (1995), of mosses – according to M.S. Ignatov *et al.* (2006). Total projective coverage of undergrowth reached 5%. Coverage of herb layer was 70%, with *Drosera rotundifolia* L. equaling 2, *Hieracium umbellatum* L. – +, *Juncus alpino-articulatus* Chaix – 1, *Lycopodium clavatum* L. – 4, *Trifolium hybridum* L. – +. Coverage of moss layer at the site was 35%, with *Aulacomnium palustre* (Hedw.) Schwaegr. covering 5%, *Pohlia nutans* (Hedw.) Lindb. – 5%, *Polytrichum commune* Hedw., *P. juniperinum* Hedw. – 25%. Both club moss and common sundew had an even distribution in the area; specimens of both species were well developed. Such communities in similar habitats have not been described in the literature.

Figure 5: Fragment of club moss – common sundew community on dry sand (Photo by Anna N. Demidova).

Phytocenology

It is known from the literature that common sundew is a dominant species of *Carex lasiocarpa – Comarum palustre – Drosera rotundifolia – Sphagnum* spp. association (Lavrenko 1940, cited by Bykov 1965); it reaches especially high abundance in swamps with the predominance of *Sphagnum magellanicum* (Galkina 1956). According to "Prodromus and diagnostic species of the highest units of vegetation of the territory of the former USSR" (Mirkin & Naumova 1998), common sundew is a diagnostic species of the following classes of swamp vegetation:

1. Oxycocco-Sphagnetea Br.-Bl. ***et*** **R. Tx.** ***ex*** **Westhoff** ***et al.*** **1946** (oligotrophic and oligo-mesotrophic sphagnous raised and intermediate swamps of holarctic regions) with the following diagnostic species: *Andromeda polifolia*, *Aulacomnium palustre*, *Baeothryon cespitosum*, *Carex pauciflora*, *Drosera rotundifolia*, *Eriophorum vaginatum*, *Oxycoccus palustris*, *Polytrichum strictum*, *Sphagnum magellanicum*;

2. Scheuchzerio-Caricetea fuscae R. Tx. 1937 (low-sedge moss mesotrophic swamps); order *Scheuchzerietalia palustris* Nordhagen 1937 (sedge-moss meso- and oligotrophic swamps) with the following diagnostic species: *Scheuchzeria palustris*, *Carex rostrata*, *Drosera anglica*, *D. rotundifolia*, *Naumburgia thyrsiflora*, *Rhynchospora alba*, *Sphagnum cuspidatum*, and presence of diagnostic species of *Oxycocco-Sphagnetea* class; union *Rhynchosporion albae* Koch 1926 (meso- and oligotrophic sedge-moss swamps) with the following diagnostic species: *Rhynchospora alba*, *R. fusca*, *Scheuchzeria palustris*, *Carex limosa*, *C. pauciflora*, *Drepanocladus fluitans*, *Drosera anglica*, *D. rotundifolia*, *Oxycoccus palustris*, *Sphagnum balticum*, *S. cuspidatum*, *S. majus*.

Nevertheless, singular occurrences of common sundew in non-typical habitats at dry substrates are known from the literature. Thus, common sundew was found in high numbers and good state by A.P. Shennikov (1964) in the Leningrad region on dry pine-forest sands. D.E. Swales (1975) found a vegetation community with large numbers of common sundew at Ile Perro (Canada) growing on dry abandoned pasture that was previously swampy land drained in the 19th century.

According to P.I. Belozyorov (2008) data, common sundew is found within the whole Kostroma

region occasionally, in sphagnous raised peat swamps. Our finding makes it possible to extend our knowledge about ecology and phytocenology of this extremely interesting swamp plant.

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News and views

The ICPS likes to hear from our readers. We especially enjoy highlighting educational events and presentations focusing on carnivorous plants around the world – especially those done by ICPS members. Recently we heard from an ICPS member in Brazil.

Bruno C. B. Ruano (brunoruano@gmail.com) writes:

I am an agronomy student of the Federal University of Paraná, located in Curitiba City, the Capital of Paraná State, Brazil. I want to share information with ICPS members about a presentation I did on April 22nd at EREA (Regional Gathering of Agronomy Students). I performed a presentation on carnivorous plants and conservation, followed by a workshop. Approximately 20 University students from all over the south of Brazil attended.

I explained the differences between the species, the environmental impact caused by our crops and cultivated fields (with the use of pesticides and fertilizers), and urban expansion. I also talked about what we can do to protect carnivorous plants and their natural habitats. I used some examples from the U.S., such as *Sarracenia* spp., and also focused on some Brazilian *Drosera* spp.

In the workshop we prepared pots I designed, that used plastic frizzy-drink bottles as mini-greenhouses, learned how to prepare soil mixtures, and how to propagate a *Dionaea* using its' leafs!

It was great! The students sure enjoyed it, especially because everybody took home a pot they prepared with a brand new *Dionaea* cutting in it!

I would like to thank Barry A. Rice, without his book Growing Carnivorous Plants and his articles, it would have been very hard to accomplish my presentation. I would also like to thank the ICPS team for letting me use some of their material, especially its president Michael Baldwin for his interest and support!

Thank you all and HAPPY GROWING!

Bob Ziemer (bob@carnivorousplants.org) writes:

In late May, I presented 4 mini-classes to 6th through 8th graders (11-14 years old) at Fieldbrook Elementary School in northern California. A total of 18 students participated this year. Each student had to sit through my boring PowerPoint presentation about carnivorous plants of the world, then dissected a *Sarracenia* leaf and tried to identify the smelly decaying prey corpses. Finally each student prepared pots with peat soil and transplanted a *Dionaea*, *Drosera capensis*, and *Sarracenia* plant, which they took home. I have taught this mini-class for years and the students are always enthusiastic.

Mike Baldwin (mike@carnivorousplants.org) writes:

In Peter D'Amato's recent CPN essay about Paul A. Zahl, he mentioned Zahl's first book, *The Lost World* (1939) that documented Zahl's expedition to Mt. Roraima in Venezuela. Mr. D'Amato indicated he hadn't been able to get a copy of the book yet, and commented that "...no doubt Zahl saw *Heliamphora* and other carnivorous plants there."

I was curious about whether Zahl mentioned any carnivorous plants in the book. My curiosity piqued, I set out to find *The Lost World* and found it through my local library's interlibrary loan service!

An engaging read, I devoured the book cover to cover. Unfortunately, I didn't find any mention of *Heliamphora* or other carnivorous plants – but what I did find was an engaging adventure-log of his trip.

His engaging writing style took me with him on his expedition, even though it happened a little over 70 years ago! A grand adventure with tales of collecting ants, hunting for diamonds, meeting and living with indigenous people. So, even though the book didn't have any CPs in it, it was still very worth the read!

Wylie Conlon | wylieconlon.com

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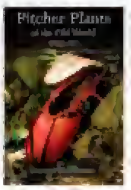

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Lost Worlds of the Guiana Highlands **(Hardcover).** 388 pages, examines the discovery of Mount Roraima and the Tepuis (home of the *Heliamphora* and many other carnivorous plants). Also explores the natural history, and diversity of plant and animal life that inhabits these ancient and unique "lost worlds". **US $48.00, UK £29.99, €35.00.** Last few copies available.

Pitcher Plants of the Americas **(Softcover).** 320 pages, examines the discovery, evolution, wild ecology, diversity and conservation of *Brocchinia*, *Catopsis*, *Darlingtonia*, *Heliamphora* and *Sarracenia*. **US $40.00, UK £24.99, €28.00.** Last few copies available. Hardcover version **sold out**.

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